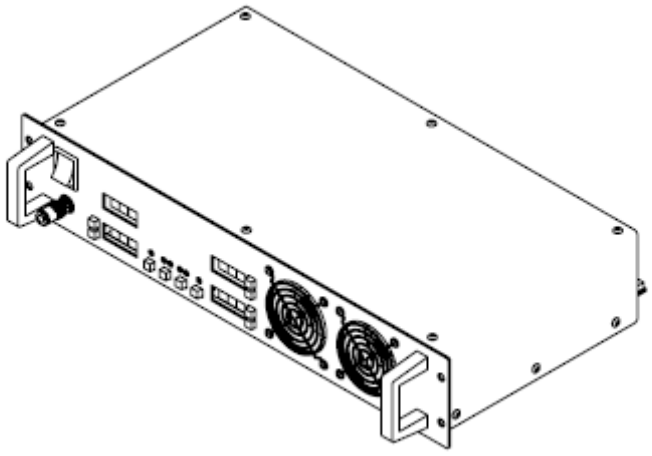
rev 1.01 / 2011 09 07

LDD-2U laser diode controller

User manual



Overview

LDD-2U laser diode controller consists of LDD-series laser diode driver, none/one/two temperature controllers, user interface and 19-inch rack mounted coverage case.

Module's input is 110VAC or 230VAC mains, module's outputs are laser diode connections and Peltiers connections. User interface is dual (front panel interface and RS-232 interface).

Module is designed for CW operations. In the spite of this the low speed modulation of the output is available (parameters of modulation are set via RS-232 interface).

Parameters selection, part numbers

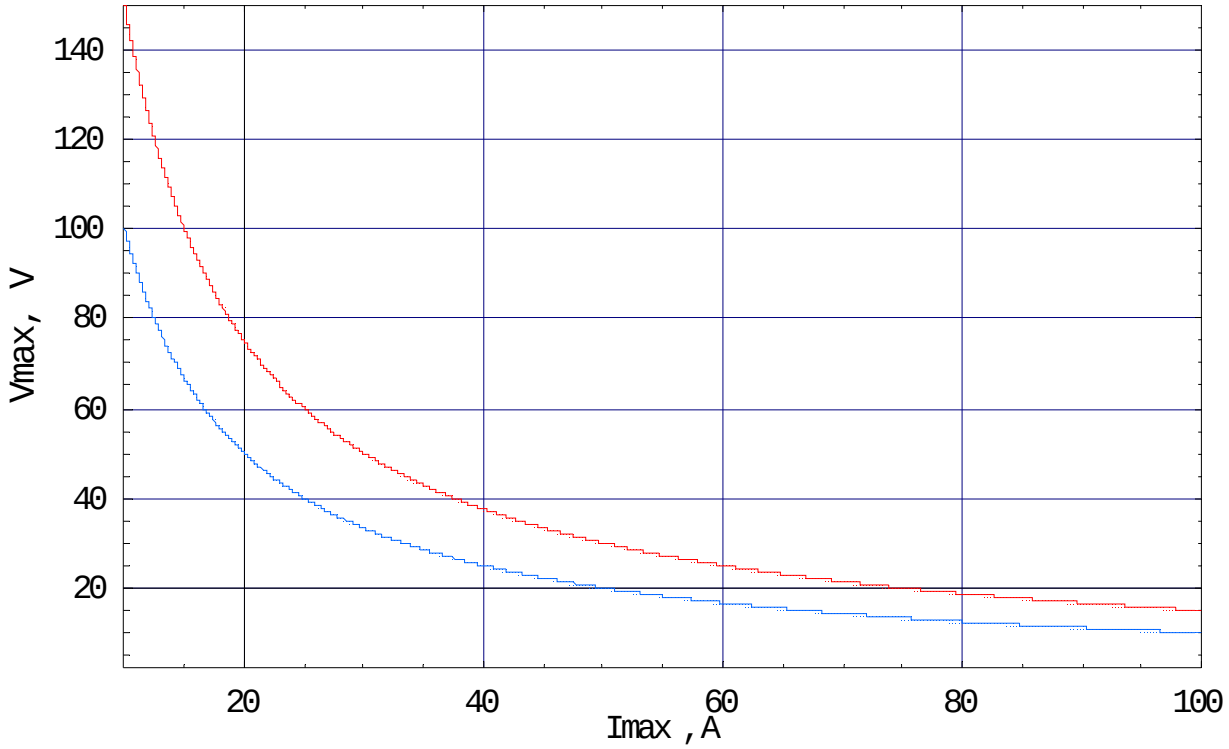
Step 1. Laser diode driver parameters.
At the beginning the parameters of the embedded laser diode driver (current source) should be selected. The most important parameters to be selected are the maximal output current and the compliance voltage.

Step 1.1. Maximal output current.
Maximal output current (I_{MAX}) is selected by the customer in range 10-100A. Module's output current can never exceed this I_{MAX} value.

Step 1.2. Compliance voltage.
Compliance voltage (V_{MAX}) is selected by the customer in range 2-150V. Module's output voltage can never exceed V_{MAX} value.

Step 1.3. Maximal output power limitations.
Maximal output power of the module (W_{MAX}) is defined as a product of I_{MAX} and V_{MAX} and can never exceed 1500W. As a result I_{MAX} and V_{MAX} parameters cannot be selected independently. Graphically their mutual dependence is depicted on the drawing below. The allowed area lies below the red curve.

Step 1.4. Input voltage limitations
Modules with the maximal output power up to 1000W can have dual 110/230VAC input. Modules in 1000-1500W range can have 230VAC input only.



Step 2. TEC controllers.

Step 2.1. Quantity of temperature controllers
You may select module with none, one or two embedded temperature controllers. In the case of two TEC controllers installed their parameters are selected and controlled in independent way. Standardly the first TEC controller is used to control the pumping diode temperature; the second one is used to control the laser rod temperature.

Step 2.2. Parameters
Each temperature controller has limitations to its maximal output current and maximal output voltage. Besides each temperature controller has limitation to its

maximal output power. As a result temperature controller parameters should be in range:

$$I_{MAX(TEC)} < 10A,\ V_{MAX(TEC)} < 20V,\ W_{MAX(TEC)} < 150W$$

Exact $I_{MAX(TEC)}$ and $V_{MAX(TEC)}$ ratio depends on V/A curve of your Peltier and should be chosen in accordance with its datasheet.

Step 2.3. Thermistor limitations
Standardly our TEC controllers are designed to get feedback from 10kOhm NTC thermistors. By default we supply them with our modules.

Sometimes laser diode assembly has already incorporated thermistor of some different kind. In that case please submit the detailed information about how the feedback loop is organized.

Step 2.4. Heating power limitations
Please note that LDD-2U cannot provide temperature control for high power laser diodes. For example 500W (optical power) laser diode produces about 500W of heat power that cannot be removed with the only 150W temperature controller.

It's your responsibility to design proper cooling system and to define its parameters precisely.

Our recommendation is not to use Peltier cooling for laser diodes with $I_{MAX} * V_{MAX} > 150W$. Of course it's just a recommendation and the certain border depends on exact design of your cooling system.

Step 3. Part numbers
Part number has the format as follows:

LDD-2U-I_{MAX}/V_{MAX}-(optionally)$I_{MAX(TEC1)}$/$V_{MAX(TEC1)}$-(optionally)R1-(optionally)$I_{MAX(TEC2)}$/$V_{MAX(TEC2)}$-(optionally)R2-(optionally)DI

where R1 and R2 is the information about your thermistors, DI means dual input option

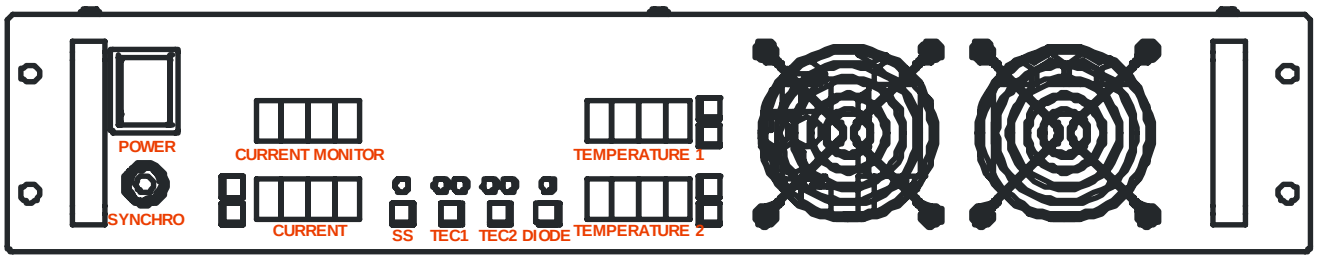
Examples.

- LDD-2U-100A/2V-8A/15V – current source with 100A maximal output current, 2V compliance voltage; one temperature controller with 8A maximal output current and 15V maximal output voltage
- LDD-2U-100A/20V-8A/15V – wrong part number, because 1) 100A * 20V exceed 1500W maximal possible output power and 2) Peltier cooling isn't recommended there

- LDD-2U-40A/4V-5A/10V-25kOhmNTC-2A/2V-DI – current source with 40A maximal output current, 4V compliance voltage; two temperature controllers; one with 5A maximal output current and 10V maximal output voltage with the feedback from 25kOhm NTC thermistor; the other has 2A, 2V parameters, feedback loop is a standard one; dual input option

Description

FRONT PANEL DESCRIPTION



POWER switch – switches module on and off

CURRENT – group of 4-digits indicator and two buttons;
is used to set diode current (from I_{MIN} to I_{MAX}; see specifications section)

TEMPERATURE1 and **TEMPERATURE2** – groups of 4-digits indicator and two buttons; are used to set temperature of the laser diode and the laser rod (from T_{MIN} to T_{MAX}; see specifications section)

Each **TEMPERATURE** group may be switched into temperature monitor mode. Pressing of two temperature buttons at the same time switches the corresponding group into the monitor mode, the second press switches it back

CURRENT MONITOR indicator – measures and indicates current through diode

SS button – turns slow start regime on and off;
Slow start rise time can be settled through the RS-232 interface, by default it's 5s

TEC1 and **TEC2** buttons – turns temperature controllers on and off;
Once this button is pressed module is trying to stabilize diode(rod) temperature. There are two LEDs nearby each TEC button.

- the left one indicates if temperature controller is turned on
- the right one indicates if diode(rod) temperature is set successfully

DIODE button – turns the current through diode on and off;
LED located nearby indicates if current is on

BACK PANEL DESCRIPTION

MAINS socket (cable is supplied with the driver) – to connect module to the mains

FUSES – two fuses; their rating depends on the laser diode driver selected

GROUND – ground stud

DIODE studs (cables are supplied with the driver) – two M6 studs to connect the laser diode to the module

TEC1 and TEC2 connectors (cables are supplied with the driver) – two Molex Minifit connectors to connect Peltier and feedback loop to the module

INTERLOCK connector – interlock circuit connection; the choke plug to short-circuit the interlock is supplied with the module

FOOTSWITCH connector – footswitch/handswitch circuit connection; simple handswitch is supplied with the driver; the choke plug to short-circuit the footswitch is also supplied with the module

RS-232 connector (cable is supplied with the driver) – to connect module to the computer

Warning! If the footswitch is already pressed when you are pressing DIODE button, the module will start operations without any further warning. **Be careful!**

Safety

Warning! This equipment produces high voltages that can be very dangerous. Don't be careless around this equipment

- During operations all protective covers of the equipment must be securely in place and all electrical connections must be properly attached
- **Don't remove protective covers!** There are no user serviceable parts inside this equipment. Do not self-repair the driver
- Module is designed to be properly grounded
- Do not turn the module on if it was already damaged with water, chemicals, mechanical or electrical shock
- Do not operate without loads attached

Faults

Module sets the fault state in the following cases:

- *module's internal overheating*
- *overheating in TEC1 channel*
- *overheating in TEC2 channel*
- *NTC1 not connected*
- *NTC2 not connected*
- *diode not connected*
- *overcurrent in DIODE channel*
- *overvoltage in DIODE channel*
- *interlock circuit interrupted*

Once the fault case has occurred you should eliminate the fault cause, then turn the module off and then turn it on again.

Operations

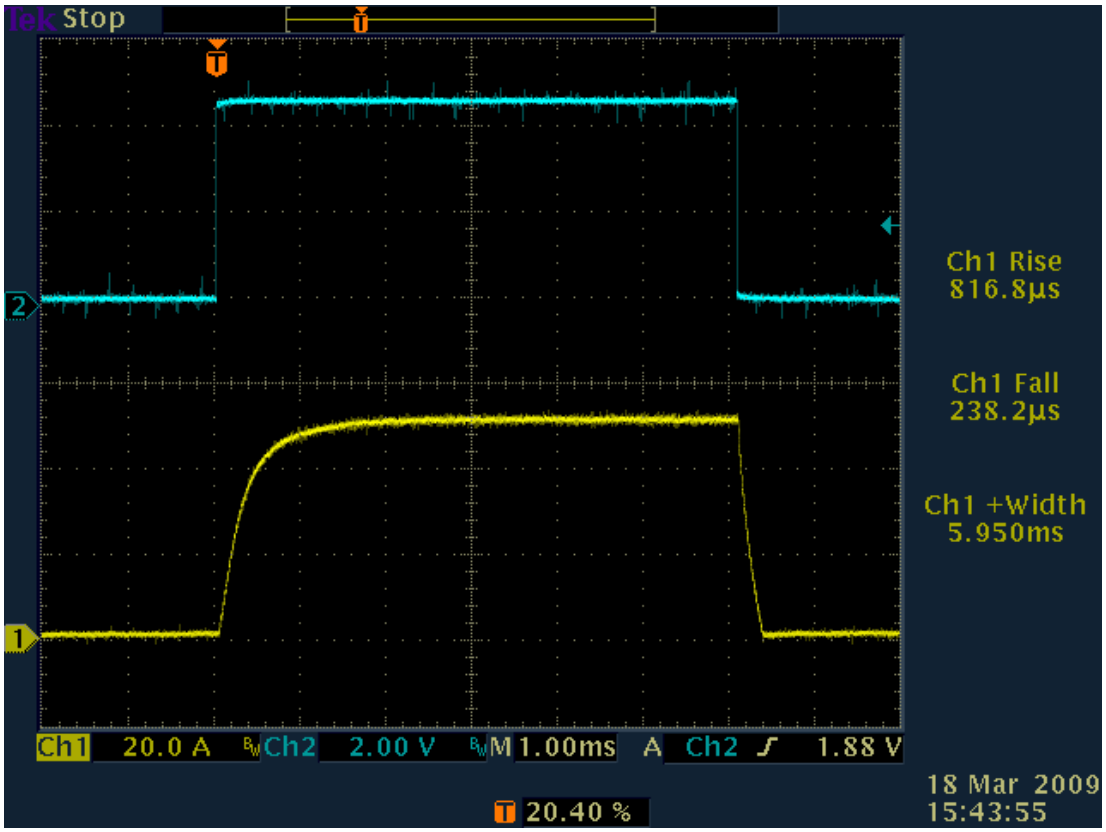
- connect laser diode to the module
- (opt.) connect Peltiers to the module
- (opt.) connect feedback loops to the module
- (opt.) connect the module to the computer
- connect footswitch (handswitch, choke plug) to the module
- connect module to the mains
- switch the module on (POWER switch)
- set desired diode current (CURRENT buttons)
- (opt.) set desired diode temperature and laser rod temperature (TEMPERATURE1 and TEMPERATURE2 buttons)
- turn on or turn off slow start (SS button), set its parameters (via RS-232)
- (opt.) select pulsed operation mode instead of CW (CW by default), set parameters of the pulsed mode (via RS-232)
- (opt.) turn temperature controllers on (TEC1 and TEC2 buttons); it's recommended to wait while desired diode temperature will become established
- enable the current through diode (DIODE button)
- press footswitch
- …
- turn the current through diode off (DIODE button)
- turn temperature controller off (TEC1 and TEC2 buttons)
- switch the module off (POWER switch)

Specifications

INPUT	
Voltage	110VAC or 110/230VAC, 50/60 Hz (depends on the output power and if DI option is selected)
LASER DIODE DRIVER SPECIFICATIONS	
Max. output current (I_{MAX})	selectable in range 10A-100A range
Max. output voltage (V_{MAX})	selectable in range 2V-150V range
Max. output power	I_{MAX} * V_{MAX}; cannot exceed 1500W
Output current adjustment range	10%-100% of I_{MAX}
Efficiency	more than 80%
Rise/fall time	< 1 ms (10% to 90% full current) < 500 us on request
Current regulation accuracy	< 1% of I_{MAX}
Current value error	< 1% of I_{MAX}
Current overshoot	< 1% of I_{MAX}
TEC CONTROLLERS SPECIFICATIONS	
Type	bidirectional
Max. output current	up to 10A
Max. output voltage	up to 20V
Max. output power	cannot exceed 150W
Feedback loop	10 kOhm NTC (other on request)
Temperature set points	10-40 ºC (other on request)
Temperature set points accuracy and stability	0.1 ºC
PROTECTIONS	
Module's overheating	70 ºC
Overheating in TEC channels	T_{MAX} + 10 ºC (other on request)
Diode overcurrent protection	+
SAFETY	
PFC value	> 0.98 (active)
Leakage current	< 500 µA
Input/output isolation voltage	4000 VAC
Safety approval	IEC60950, IEC60601-1
EMC approval	EN55011 (Class A)
COOLING	Forced air cooling with embedded fans
DIMENSIONS	19'' width; 2U height; 250mm depth
ENVIRONMENT	

Operation temperature	0 … +40 °C
Storage temperature	-20 … +60 °C
Humidity	90%, non-condensing

Typical output



Yellow curve depicts some arbitrary output current pulse. Timescale is 1 ms/div.

RS-232 interface description

RS-232 connection parameters: 38400 bps, 8 data bits, 1 stop bit, no parity.

Command format is: {command} {data (optionally)} {end-of-line}

- command is 1 character long (see list below)
- data is ASCII-string of adjusting value
- end-of-line symbols are \r\n or \n

List of available commands:

- set/get diode current - c/C (in ampere)
- set/get repetition rate - f/F (in Hz, 0 for CW mode, in dependence on pulse width some values can be ignored)
- set/get pulse width – p/P (in milliseconds)
- set/get temperature – t/T and g/G (in degrees)
- set/get slowstart time - s/S (is seconds)
- set/get SS button state - a/A
- set/get TEC1 button state - j/J
- set/get TEC2 button state - u/U
- set/get DIODE button state - r/R
- get current monitor value - Y
- get temperature monitors value – W and Q
- get the fault state - Z
- echo on/off - e

Warning! It's possible, but it isn't recommended to use front panel user interface and rs-232 user interface at the same time